

HOW I DO IT

Posterior Compartment Resection of the Thigh for Soft-Tissue Sarcomas

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INTRODUCTION

In the past, the rate of amputation for extremity soft-tissue sarcomas in referral centers was in the range of 40% to 50% [1,2]. Over the past 20 years, however, the rate of amputation has declined to about 5% [3]. This improvement in the rate of limb-preserving resection has been the result of a combination of modalities, specifically the use of adjuvant radiation in conjunction with more conservative resection, as well as refinement of surgical techniques. In most anatomical areas of the extremities, wide resection is practiced because a compartment resection would not be consistent with a functionally intact extremity. In the area of the thigh, however, there is opportunity for compartment resection because this does not substantially interfere with the function of the extremity. In the anterior thigh, a modified compartment resection with preservation of the distal portion of vastus medialis and its nerve supply retains valuable active extension for the knee joint [4]. The medial and posterior compartments of the thigh can be resected without appreciable effect on routine activities.

The basic steps of posterior compartment resection have been described previously [5]. In the following, the technique of posterior compartment resection of the thigh for soft-tissue sarcoma is described, with special emphasis on the approach and dissection of the sciatic nerve.

SURGICAL TECHNIQUE

It is possible to perform a posterior compartment resection through an anterior approach with the patient in a supine position, but this becomes advisable or necessary only in patients who have involvement of the medial as well as the posterior compartment. In such cases, a longitudinal incision on the anteromedial aspect of the thigh can be made with the patient in a supine position. The insertions of the three layers of the adductor group of muscles are divided near the linea aspera, following exposure and dissection of the superficial femoral vessels;

the sciatic nerve is found posterior to the insertion of the adductor magnus, within the posterior compartment. Having thus identified the sciatic nerve through this anterior approach, and dissected it from the posterior surface of adductor magnus, it is possible to proceed unhampered with resection of the posterior compartment through this anterior approach.

However, the standard approach for posterior compartment resection in a sarcoma that does not involve the adjacent compartments or involves minimally the adjacent compartments is most easily the posterior approach with the patient in a prone position. A longitudinal incision is made from the buttock over the middle of the posterior thigh to the popliteal fossa. Any previous biopsy incision is circumscribed by making an elliptical incision. Flaps are then developed so one can maintain a sufficient distance from the previous biopsy track, if there is one, and the flaps are developed to the margins of the palpable extent of the tumor. The deep fascia is incised beyond the palpable extent of the tumor all the way around. Superiorly, if the location of the tumor warrants it, the curving muscle fibers of the border of gluteus maximus are divided through the full thickness of the muscle along the incision to provide exposure of the sciatic nerve between the greater trochanter and the ischial tuberosity.

The sciatic nerve is coursing on the surface of quadratus femoris between these two anatomical osseous boundaries. At this point, one can divide the origin of the hamstring muscles just distal to the ischial tuberosity. The sciatic nerve proximally is located lateral to the origin of the hamstring muscles, but as it proceeds toward the middle and distal thigh, it assumes a position between

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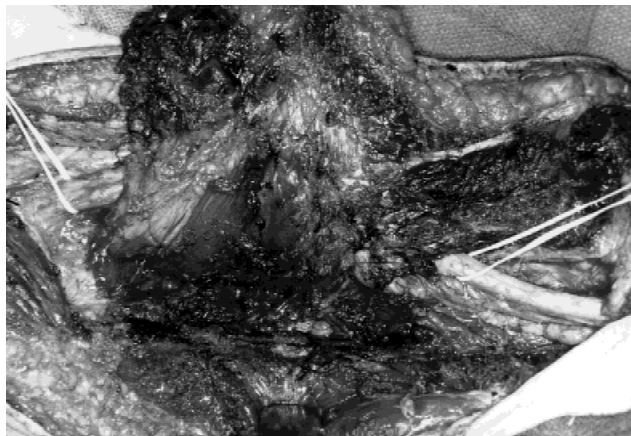


Fig. 1. Sarcoma of the posterior thigh mobilized with the sciatic nerve exposed and surrounded by vessel loops, proximal and distal to the specimen.

the laterally located biceps femoris and the medially located semimembranosus and semitendinosus muscles. Distally, after the fascia is incised, the sciatic nerve or its branches (in most cases, the nerve has already bifurcated) are exposed, with the tibial nerve being near the midline and the common peroneal nerve medial to the margin of the biceps femoris. These two nerves are traced superiorly and dissected by entering the nerve sheath. The fascia lata is incised medial and lateral to the tumor mass. The specimen thus is mobilized and should be dissected off the surface of adductor magnus. In some cases, part of the adductor magnus may be resected if the tumor approaches close to the surface of this muscle. Behind the knee joint, the tendons of semitendinosus, semimembranosus, and biceps femoris are divided (the short head of the biceps adhering to the surface of the femur may also be resected if close to the tumor).

The specimen, being completely mobilized, can be rotated medially or laterally to identify the most direct approach to the sciatic nerve, which is now contained in the specimen (Fig. 1). By observing the exposed and dissected proximal part of the nerve as well as its distal branches, one can perceive the plane that one should pursue to extricate the sciatic nerve from the specimen through a plane that will not violate the tumor (Fig. 2). One, in effect, can dissect on the surface of the sciatic nerve that is closest to the surface of the specimen and enter the sheath of the nerve so that the nerve itself may be retracted with vessel loops around its trunk proximally as well as its branches distally, and be separated from its sheath—which is left on the tumor side to be removed with the specimen (Fig. 3). This allows the freeing of the sciatic nerve and its branches from the specimen and avoids violation of planes that may be occupied by the tumor (Fig. 4).

Patients with sarcomas close to the sciatic nerve



Fig. 2. The sciatic nerve has been dissected off the specimen.

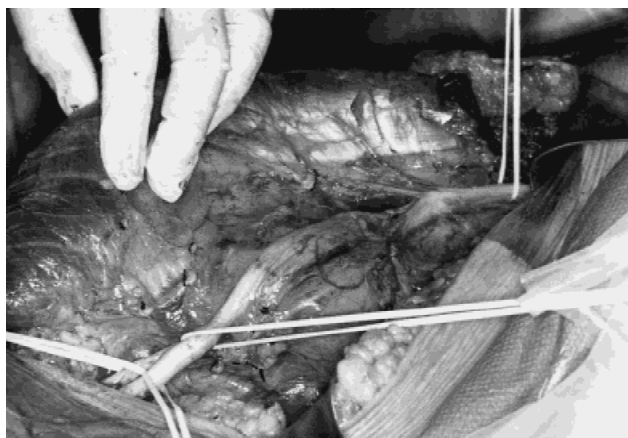


Fig. 3. The posterior compartment has been mobilized, and the sciatic nerve is viewed from its anterior (deep) surface. A deliberate, informed decision can be made as to whether the nerve can be preserved.

should receive preoperative or postoperative adjuvant radiation in order to enhance the local control rate. In rare instances, if the nerve is circumferentially involved or actually invaded by the tumor, it may be sacrificed. In the latter case, patients are still able to walk without external support with what amounts to a foot drop. They have sensation in the front of the leg by virtue of the saphenous branch of the femoral nerve, but their calf and plantar aspect of the foot are insensate. They can extend the knee, of course, but also flex it by the action of sartorius and gracilis (Fig. 5). The result is definitely superior to a high thigh amputation, hip disarticulation, or hemipelvectomy. In most instances, however, one should be able to preserve the sciatic nerve by entering the sheath of the nerve trunk proximally and its branches distally in the popliteal fossa and proceed to dissect the nerve from what is to become specimen through a surgical plane that is not involved by tumor and represents the shortest distance between the specimen surface and the nerve trunk.



Fig. 4. Operative field after resection of the posterior compartment of Figure 3, showing the sciatic nerve and its bifurcation.

DISCUSSION

The technical points important in the performance of the posterior compartment resection of the thigh in association with a sarcoma are: 1) development of flaps beyond the palpable extent of the tumor and then incision of the fascial lata, which permits partial mobilization of the specimen; 2) proximal exposure of the sciatic nerve at the level of the buttock, if the tumor is close to that area, by incising the inferior curving muscle fibers of the gluteus maximus and exposing the sciatic nerve between the ischial tuberosity and greater trochanter; 3) exposure of the branches of the sciatic nerve in the popliteal fossa; 4) mobilization of the specimen by dissecting it off the posterior aspect of adductor magnus and by dividing the origin of the hamstring muscles off the ischial tuberosity and their respective tendons at the level of the popliteal fossa behind the knee joint; 5) sharp dissection to the surface of the sciatic nerve, which at this point has been mobilized with the specimen by identifying the shortest route between the nerve trunk and specimen surface that is not occupied by tumor; and 6) further dissection of the sciatic by incising the sheath of the free proximal trunk and that of its branches and by surrounding these nerves with vessel loops so that the entire length of the nerve is freed while the sheath of the nerve is left on the specimen.

Function of the lower extremity following posterior compartment resection is essentially unchanged (at least for ordinary activities) compared with the preoperative state. The patients are still able to flex their knee joint actively through the action of sartorius and gracilis and through the action of gastronemius, since its two heads originate from the femoral condyles.

Posterior compartment resection of the thigh is the preferred surgical treatment for a large soft-tissue sarcoma in this area. It certainly can be modified to include



Fig. 5. Functional status of the right lower extremity after posterior compartment resection en bloc with the sciatic nerve divided just below the level of the buttock due to a malignant schwannoma originating in this nerve.

only one or two of the three hamstring muscles if the remaining hamstring(s) are not close to the tumor. It provides the opportunity for local control in the thigh with excellent postoperative function, and in most patients, an adequate surgical margin.

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